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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicants:	James C. Anderson, et al.	Examiner:	Jason C. Olson
Serial No.:	10/719,515	Group Art Unit:	2627
Filed:	November 20, 2003	Docket No.:	200309574-1
Title:	Method and Apparatus for Storing Data on Magnetic Tape		

**DECLARATION UNDER 37 CFR § 1.131**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

We, James C. Anderson, Martin J. Harper, Vernon L. Knowles, and Donald J. Fasen, declare as follows:

1. We are the named co-inventors in the above-captioned patent application and of the subject matter described and claimed therein.
2. The invention in the above-captioned patent application was conceived by James C. Anderson, Martin J. Harper, Vernon L. Knowles, and Donald J. Fasen, collaborating as co-inventors.
3. The invention described and claimed in the above-captioned US patent application was actually reduced to practice in the United States by James C. Anderson, Martin J. Harper, Vernon L. Knowles, and Donald J. Fasen prior to September 12, 2003, the effective date of USPN 2005/0057843 (Egan).
4. Exhibit 1, attached hereto, is a redacted copy of the invention disclosure for above-captioned US patent application. The invention disclosure was signed by James C. Anderson, Martin J. Harper, Vernon L. Knowles, and Donald J. Fasen in January 2003 prior to September 12, 2003, the effective date of USPN 2005/0057843 (Egan).

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Application No. 11/253,233  
Declaration under 37 CFR 1.131

5. Exhibit 1, attached hereto, also includes a report entitled "Investigating the Benefits of an Accelerometer in Gen3." This report was attached to the original invention disclosure and shows that the invention and claimed subject matter were actually reduced to practice in the United States prior to September 12, 2003, the effective date of USPN 2005/0057843 (Egan). Accordingly, Exhibit 1 shows that the structure described and claimed in the above-captioned patent application was reduced to practice prior to the effective date of September 12, 2003 of Egan.

We declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or an patent issuing thereon.

James C. Anderson

Dated: June 27, 2006

Martin J. Harper

Dated: June 27, 2006

Vernon L. Knowles

Dated: June 27, 2006

Donald J. Fasen

Dated: June 29, 2006

TAPE.US

	INVENTION DISCLOSURE	PAGE ONE OF 7 ATTORNEY
PDNO 200309574 DATE RCVD		1.31.03

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**Descriptive Title of Invention:**

Tape drive Head Positioning Servo System With Accelerometer Input for Improved Shock and Vibration Performance

**Name of Project:** Ultrium Linear Tape Drive**Product Name or Number:**

Was a description of the invention published, or are you planning to publish? If so, the date(s) and publication(s):

No

Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, the date(s) and location(s):

No

Was the invention disclosed to anyone outside of HP, or will such disclosure occur? If so, the date(s) and name(s):

Yes. Jabil Vienna. They do the mechanism design and manufacturing.

*If any of the above situations will occur within 3 months, call your IP attorney or the Legal Department now at 1-857-2542 or 415-867-2642*

Was the invention described in a lab book or other record? If so, please identify (lab book #, etc.)

Yes, <http://gb2www.bsi.hpl.hp.com/ndon/hdpos/shock-vib/shock-vib.htm>

Was the invention built or tested? If so, the date:

Yes, 20-Nov-02 3/23/2000

Was this invention made under a government contract? If so, the agency and contract number:

No

**Description of Invention:** Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).

- A. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).
- B. Problems solved by the invention.
- C. Advantages of the invention over what has been done before.
- D. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)

**Signature of Inventor(s):** Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: [ 21 Jun 03 ]  
H. F. BOISE LEGAL

Employee No.	Name	Signature	396-4225	477	CPB R&D
91965	James C. Anderson	<i>James C. Anderson</i>	Telnet	Mailstop	Entity & Lab Name
434867	Marin J. Harper	<i>Marin J. Harper</i>	396-2785	477	CPB R&D
48352	Vernon L. Knowles	<i>Vernon L. Knowles</i>	396-2452	477	CPB R&D
348128	Donald J. Fasen	<i>Donald J. Fasen</i>	396-3299	400	PSR R&D
		Signature	Telnet	Mailstop	Entity & Lab Name

*(If more than four inventors, include additional information on another copy of this form and attach to this document)*

<b>Hewlett-Packard INVENTION DISCLOSURE</b>		COMPANY CONFIDENTIAL	PAGE <u>1</u> OF <u>7</u>
<b>Signature of Witness(es):</b> (Please try to obtain the signature of the person(s) to whom invention was first disclosed.) The invention was first explained to, and understood by, me (us) on this date: [ <u>Jun 73 CB</u> ]			
Full Name <u>TED A. BROOKS</u>	Signature <u>TABE BROOKS</u>	Date of Signature <u>1/24/2003</u>	
Full Name <u>James Clifford Anderson</u>	Signature <u>James Clifford Anderson</u>	Date of Signature <u>1/24/2003</u>	
<b>Inventor &amp; Home Address Information:</b> (If more than four inventors, include add'l. information on a copy of this form & attach to this document)			
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Inventor's Full Name Donald J. Fasen			
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Do you have a Residential P.O. Address? P.O. BOX No	City	State	Zip
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## **Tape Drive Head Positioning Servo System With Accelerometer Input for Improved Shock & Vibration Performance**

Tape drives will continue to evolve and store more user data on each cartridge. This will require increased track and linear bit densities. As the track spacing gets narrower it becomes more difficult to position the read/write heads over the data tracks within the accuracy required especially with external shock and vibration shaking the product. This invention describes using an accelerometer mounted in the tape drive to measure the external disturbance and feed that signal into the head positioning servo system. This signal can be used to control electrical current into the head positioning voice coil motor to move the head and follow the effects of external vibration. With this invention, the error in positioning the head to the tape track center due to external vibration can be virtually eliminated. (See the attached report by Martin Harper)

To get the best feedback from the accelerometer it should be located as close to the read/write head as possible since it is the magnitude of the external disturbance at the head that needs to be compensated for. It also must measure acceleration in the same axis as the head positioning actuator moves since this is the direction the head becomes off of tape track center. Since all of the HP Ultrium products use a common head positioning actuator it is desirable to build the accelerometer into the actuator so that it can easily be added to all drive platforms and be in close proximity of the head. One way to accomplish this is to place the accelerometer and accompanying electronics on the variable inductance (VI) pga, which is located on the actuator.

For the accelerometer enhanced servo system to work properly the tape drive should have an isolation mounting system to remove the higher frequency components of vibration from reaching the chassis. Typically the resonant frequency of the chassis on the isolation mounts is 50 to 200 Hz. This isolation mounting system usually consists of rubber grommets that isolate the drive chassis from the mounting points. Don Fasen did testing several years ago on an accelerometer enhanced servo system on the Einstein drive that did not have isolation mounts. This system did not work well because external vibrations in 300 to 500 Hz frequency range excited bending modes of the chassis. Because of these bending modes the accelerometer did not accurately measure the difference in acceleration between the head and the tape.

Inventors: *Gordon C. Anderson* 1/21/03

*Donald J. Fasen* 1/22/03

*Mark J. Hayes* 1/22/03

*Umar L. Khanba* 1/23/03

Witnesses:

*Turk Johnson* 1/24/03

*John R. - J. McElroy*

3/7

Investigating the Benefit of an Accelerometer in Gen3

Page 1 of 4

## Investigating the Benefit of an Accelerometer in Gen3

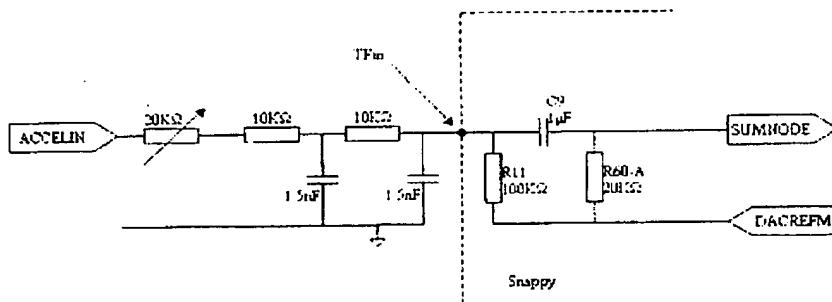
Report by: Martin Harper

Last Updated: [REDACTED]

**Executive Summary**

Using a laboratory grade accelerometer with hand built additional circuitry and manual calibration, a Faraday drive with the Faraday MR compensator design passed with margin the roadmap Gen 4 track pitch (1024 tracks) offtrack limit specification whilst being subjected to 0.3g 5 - 500Hz random vibration.

These are the results of the initial investigation into the potential benefits (if any) of using an accelerometer as part of the head position servo tracking control loop. The set up consisted of a laboratory accelerometer and charge amp with output from the charge amp scaled to 1V per G. The output was fed through a potentiometer for signal level matching then into a low pass filter with a cutoff of 10KHz as there were some issues with a pure tone appearing from the accelerometer at around 36KHz. The output of the filter was then fed directly into TPin on the snappy allowing the use of the built in coupling capacitor and input resistance to the summing node in the servo loop. These form a high pass filter stage with a cutin of around 10Hz. A representation of the circuit is shown below.



In all these tests, Faraday drive #F33001312 was used in normal orientation unless otherwise stated. The Random vibration 5 - 500Hz transfer function measurements were taken at various levels noted with the results. The method of calibration was to determine the resonant frequency of the shock mounts from the random transfer function without the accelerometer, around 160Hz. The table was then set to dwell at this frequency so PES could be monitored as the accelerometer feedback was fed into the loop. The feedback signal level was adjusted using the potentiometer until the sine wave present in PES was at a minimum. When set, repeat measurements of random vibration, 5 - 500Hz at various levels were done to determine the effect. PesScans were also done to note any change in the number of events and PES sigma values. All the results are shown below;

Tested by: James L. Ambrose 1/22/03  
 Donald J. Traven 1/22/03  
 [Signature] 1/22/03  
 file:///C:/data/temp/Gen3.htm  
 James L. Ambrose 1/22/03

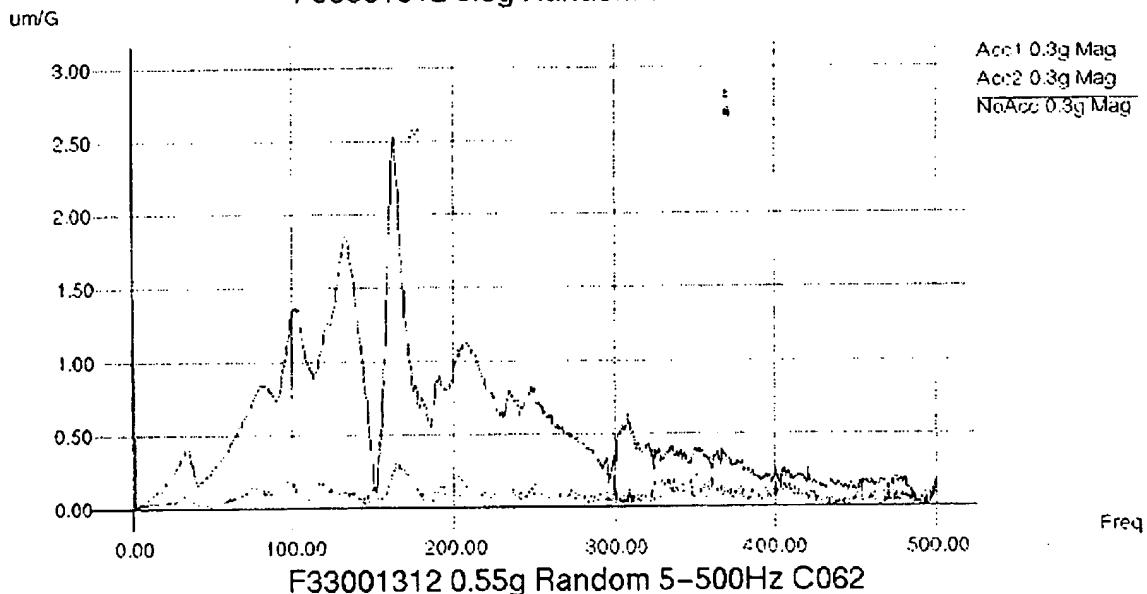
Witnessed: [Signature] 1/22/03 4/7  
 [Signature] 1/22/03  
 1/22/03

11/20/2002

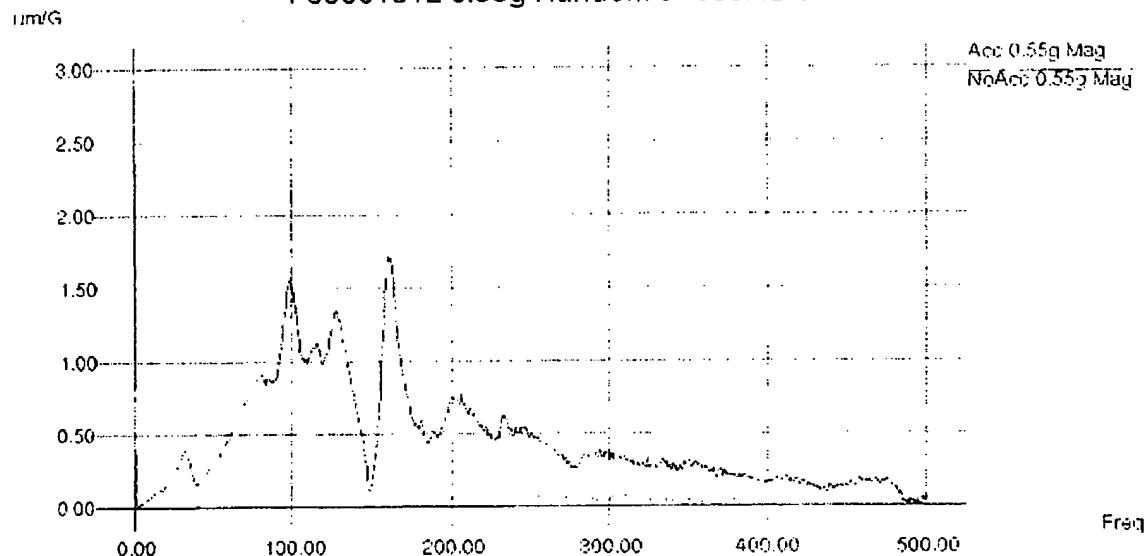
Investigating the Benefit of an Accelerometer in Gen3

Page 2 of 4

## F33001312 0.3g Random 5-500Hz C062



## F33001312 0.55g Random 5-500Hz C062



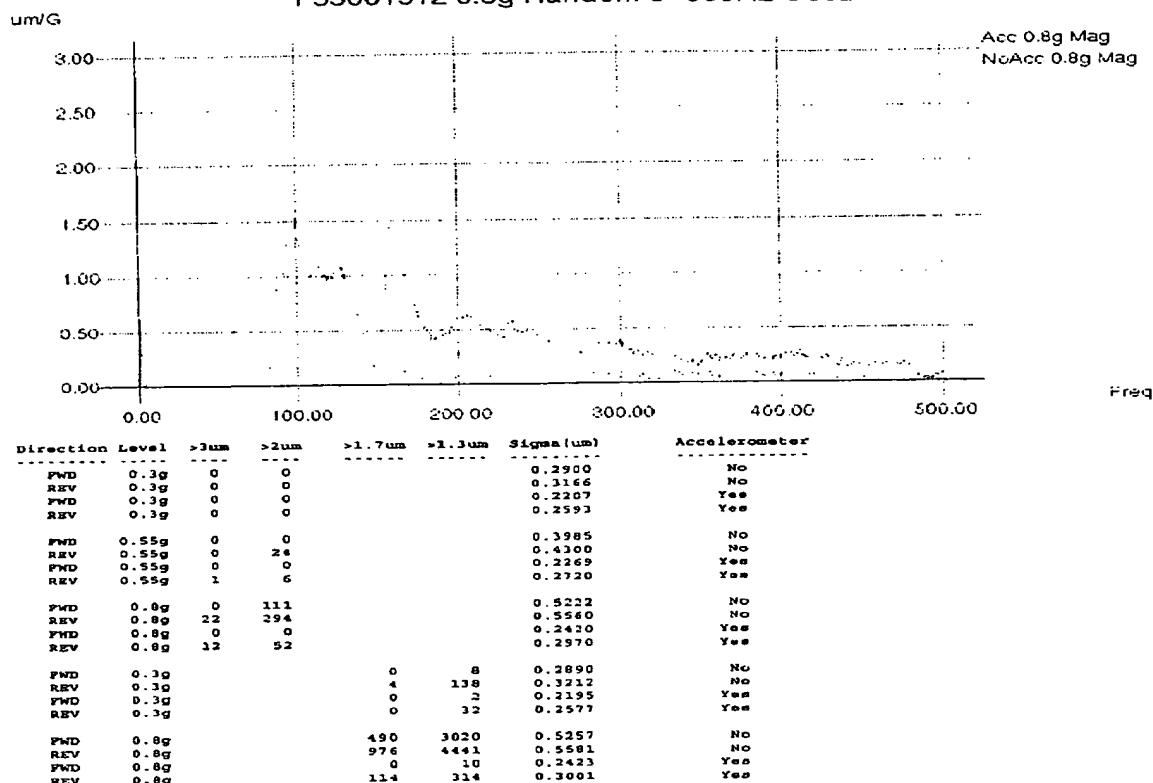
Inventors: James C Anderson 1/3/03  
 Donald J Jason 1/22/03  
 Martin J Hayes 1/21/03  
 Vernon L Kunkle 1/23/03

Witnesses:  
 Donald J Jason 1/22/03  
 Vernon L Kunkle 1/23/03

Investigating the Benefit of an Accelerometer in Gen3

Page 3 of 4

## F33001312 0.8g Random 5-500Hz C062

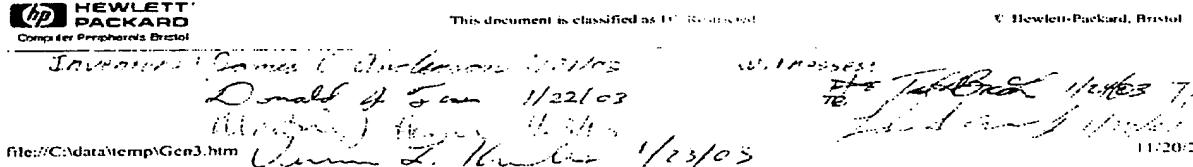


Next I looked at Tape Path Down orientation and was a little surprised at what I saw. I was expecting the table to PES transfer function to look a little different now the vibration was acting against the guide rails on the actuator. It's true to say they are different but there are still significant in plane disturbances measured by the accelerometer. The good news seems to be that the accelerometer as used made an equally good job of cancelling these effects. Both forward and reverse transfer functions were taken from table to PES:

Involved: James C. Mckerley 1/21/03 Witnessed:  
 Donald G. Tamm 1/22/03  
 Alfonso J. Lopez 1/23/03  
 Dunn L. Mueller 1/23/03 Test & Signatures:  
 1/23/03

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Calvin Mckerley

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